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(54) Disc clamping and centering apparatus

(57) A turntable 11 has a disc holding surface 12, a shaft bore 15 mounted on a motor shaft 14 and an annular recess 17. A clamper 10 has a portion 18 for urging a disc onto the holding surface and a ring like projection 19 which is inserted through a centre hole 5 of the disc 2 into the annular recess for alignment purposes. The disc is manually transferred with the clamper in an upper set position (fig 2) which is subsequently lowered once the disk is in position. The clamper may have protuberances (41, figs 3 and 4) to help retain the disk, and a tapered ring-like projection (42, fig 3) for insertion through a centre hole of the disk.

FIG. 1

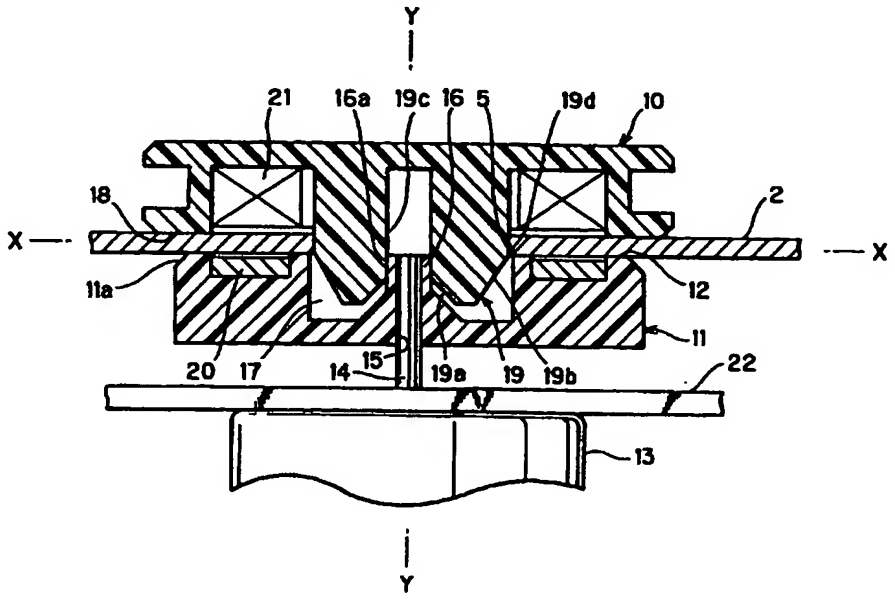


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FIG. 1

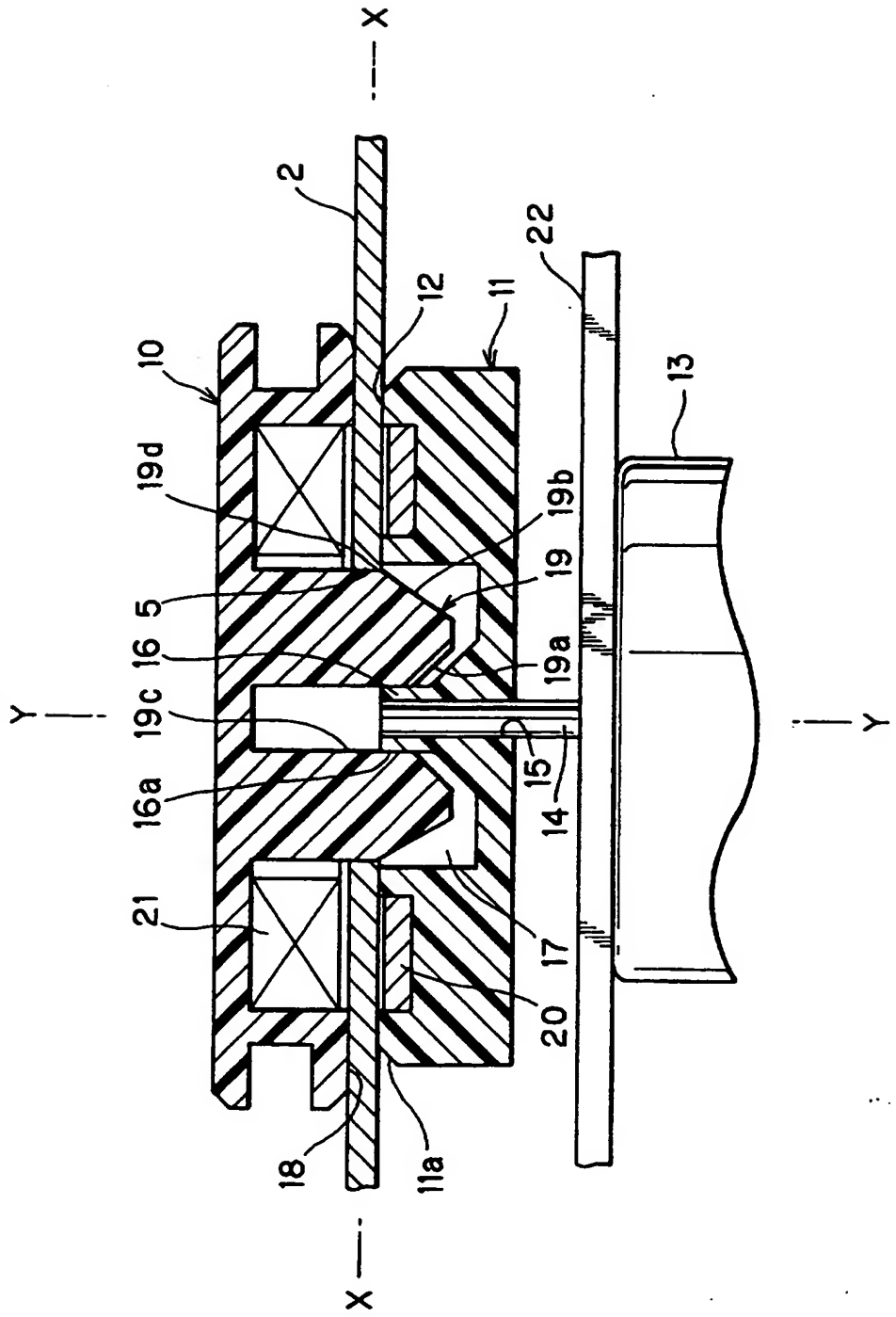


FIG. 2

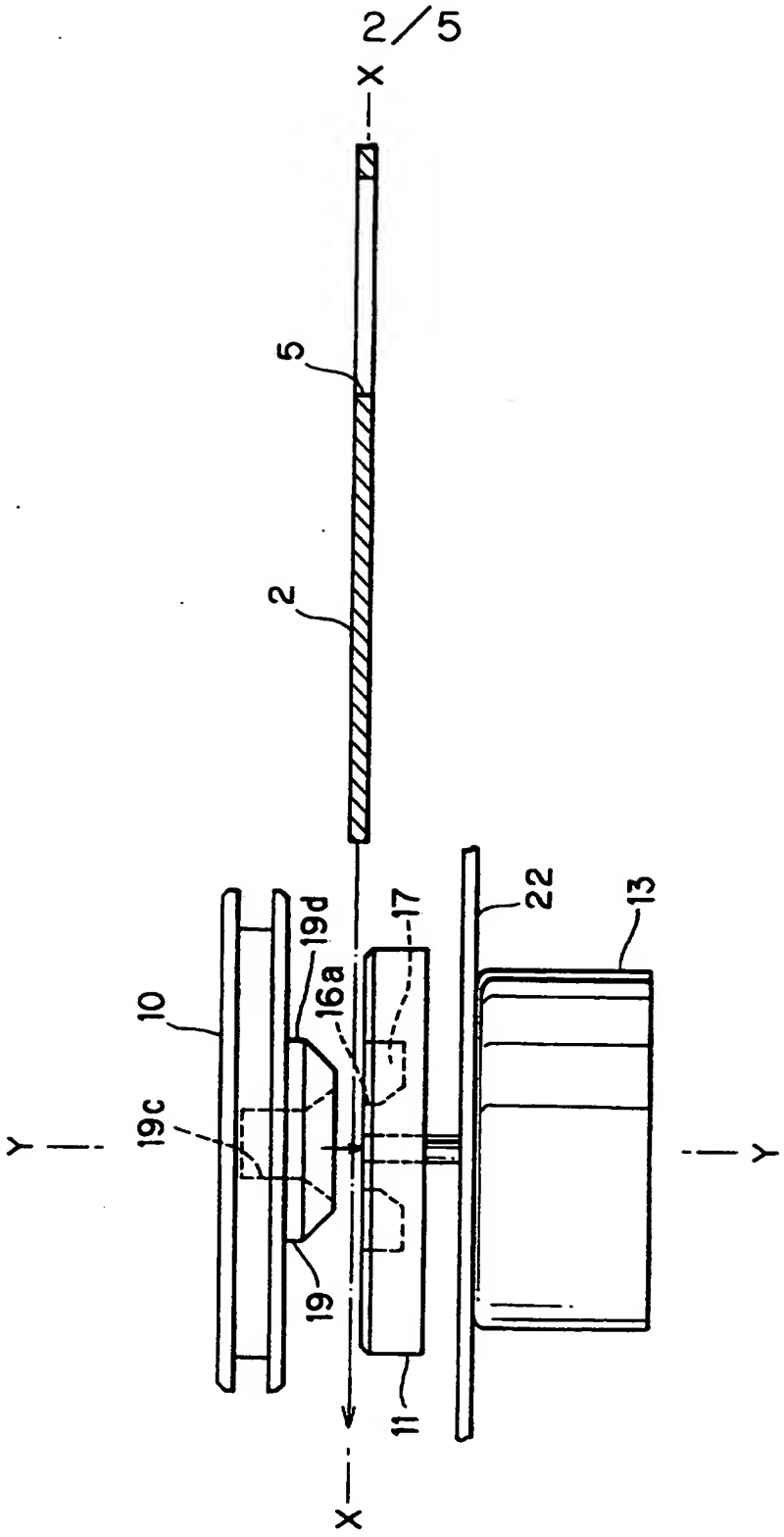


FIG. 3

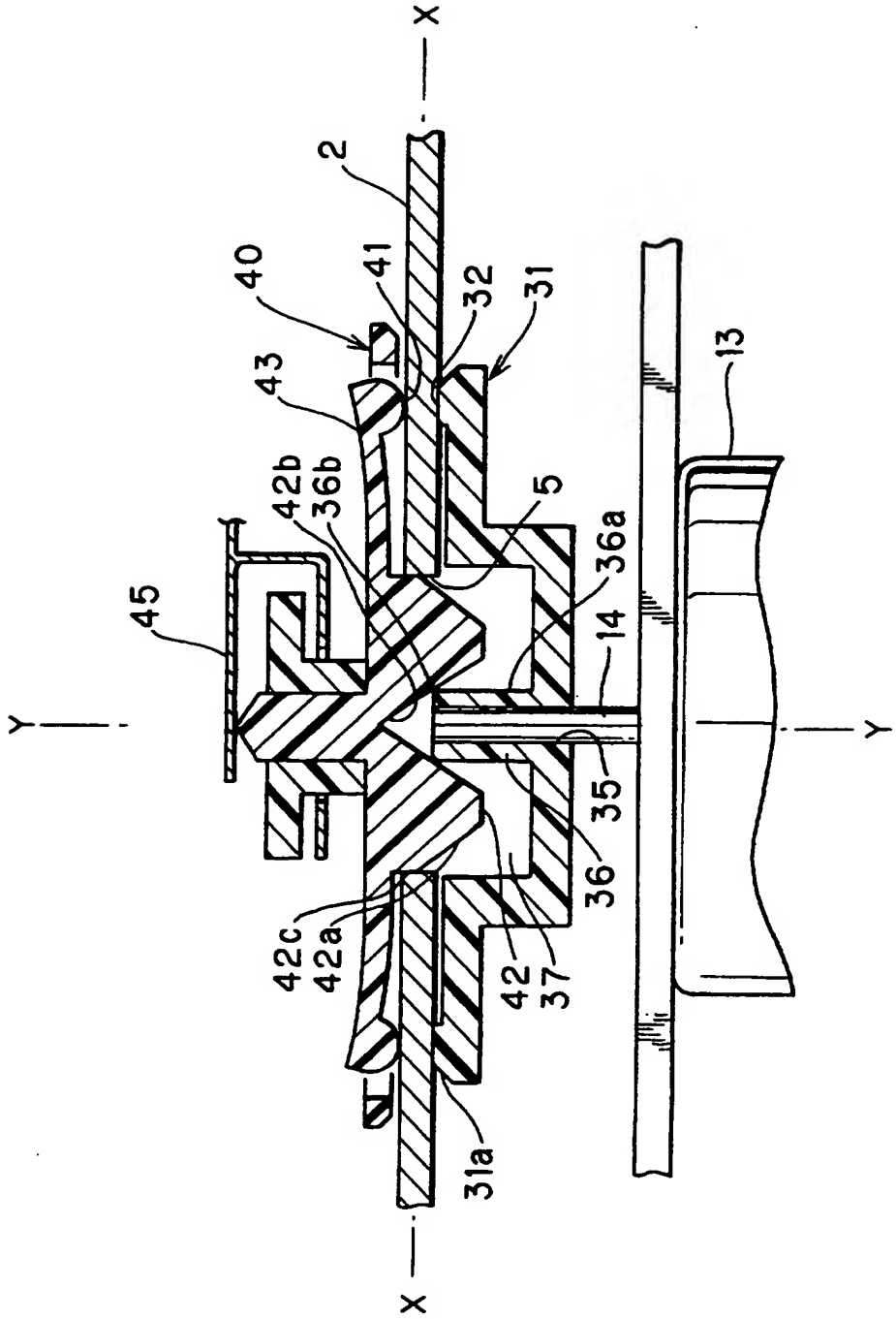


FIG. 4

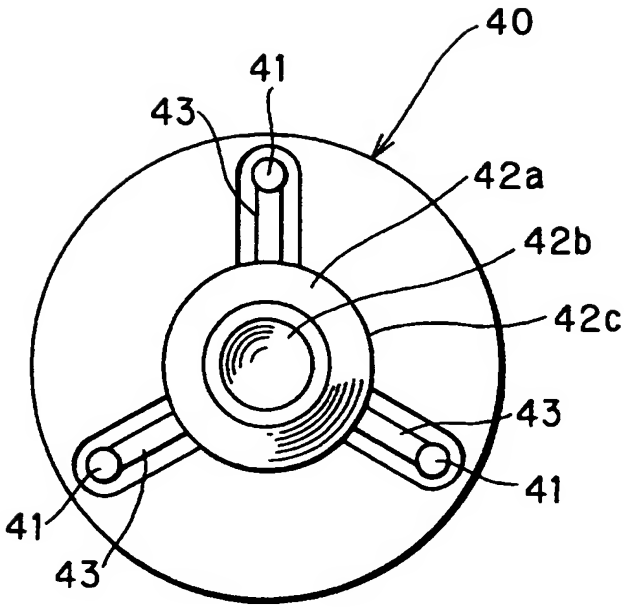
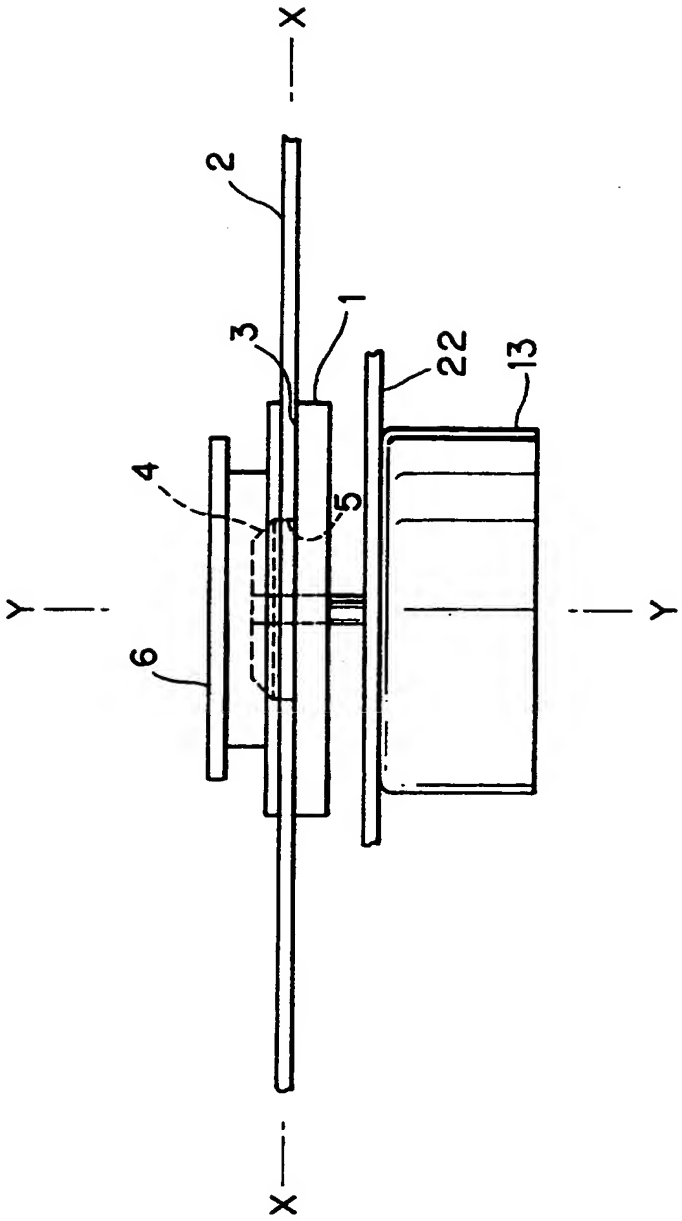


FIG. 5



# DISC CLAMPING APPARATUS

This invention relates to a disc clamping apparatus for clamping a disc between the disc holding surface of a turntable and a clamper of a CD player or the like.

In the prior art apparatus of this type, a function of prescribing the position of the disc in the axial direction and a function of prohibiting the transfer movement of the disc in a direction perpendicular to the axial direction, are both provided on the turntable side.

As shown in Fig. 5, the turntable 1 has a disc holding surface 3 for prescribing the position of the disc 2 in the axial direction (Y-Y) thereof and a raised portion 4 provided on a central portion of the disc holding surface 3. The transfer movement of the disc 2 in a direction (X-X) perpendicular to the axial direction (Y-Y) is prevented by fitting a center hole 5 of the disc 2 on the raised portion 4. The clamper 6 has a sole function of keeping the disc 2 held on the disc holding surface 2.

With this prior art construction, when loading the disc 2 on the turntable 1 by transferring it in the direction (X-X) perpendicular to the axial direction (Y-Y), it is necessary to raise the turntable 1 or lower the disc 2 after the disc 2 has been transferred in the direction (X-X) perpendicular to the axis (Y-Y) of the disc 2 because the turntable 1 has the raised portion 4 higher in level than the disc holding surface 3.

This means that means for raising and lowering the turntable 1 or the disc 2 should be provided in the CD player or the like when assembling the apparatus therein, thus complicating the construction of the CD player or the like. In addition, a space permitting the raising and lowering should be provided in the CD player or the like, thus increasing the size thereof.

Japanese Utility Model Publication No. 3-9163 shows a construction like the well-known disc clamping apparatus shown in Fig. 5. In this construction, like the construction shown in Fig. 5, the turntable has a central raised portion and a disc holding surface surrounding the raised portion and lower in level than the raised portion. Therefore, the turntable and the disc have to be relatively transferred in the axial direction to load the disc on the disc holding surface, and this poses the same problems as in the construction shown in Fig. 5.

In a well-know disc clamping apparatus shown in Japanese Utility Model Publication No. 62-32370, a turntable is used the top of which has a deep central recess and an annular disc holding surface surrounding the recess. A clamper facing the turntable has a downward projected portion, which has a cylindrical surface and a flange portion provided thereon. The cylindrical surface is engaged in a center hole of a disk and the recess of the turntable to align the disc and the turntable to each other, and the flange portion pushes the aligned disc against the disc holding surface.

With this construction, the disc can be held on the turntable by transferring the disc over the turntable along the

disc holding surface and then bringing the clamper toward the turntable. The construction thus permits size reduction of a CD player or the like. However, it has the following problem.

The projected portion should have a tapered end surface extending from the cylindrical surface to guide the center of the disc to the center of the turntable with the tapered end surface. Since the cylindrical surface should be engaged in the center hole of the disc and the recess of the turntable, its axial length dimension has to be greater than the thickness of the disc.

Therefore, when the axial dimension of the turntable is to be made as small as possible, the inclination angle of the tapered surface has to be increased. Increasing the inclination of the tapered surface, however, results in spoiling the function thereof to guide the disc center to the turntable center.

Japanese Patent Publication No. 62-31419 shows a disc clamping apparatus like the apparatus shown in Japanese Utility Model Publication No. 62-32370. This disclosed apparatus, therefore, has the same problem as discussed above.

The present invention is as claimed in the claims.

The disc clamping apparatus according to the present invention, has a turntable which is incapable of being axially moved relative to a disc transfer plane. The turntable has a cylindrical boss secured to a motor shaft, and an annular recess defined between the boss and a disc holding surface.

The boss does not project from the disc holding surface or portion. A clamper of the apparatus has an urging portion and a ring-like projection.

After the disc has been transferred in a direction substantially parallel to the disc holding surface, the clamper is brought toward the turntable, thus causing engagement of the outer periphery of the ring-like projection in a central hole of the disc to prohibit the transfer movement thereof in the direction of the disc plane and also engagement of the inner periphery of the ring-like projection on the outer periphery of the boss to align the clamper and the turntable to each other.

With the disc clamping apparatus according to the invention, since the turntable has no part projecting from the disc holding surface, the disc can be loaded on and unloaded from the turntable without transferring the turntable and the disc in the axial direction. Thus, the construction can be simplified.

In addition, since the ring-like projection of the clamper is fitted with its outer periphery in the center hole of the disc and also fitted with its inner periphery on the cylindrical boss of the turntable, it need not have any outer peripheral cylindrical surface. Even when the ring-like projection has an outer peripheral cylindrical surface, the axial length dimension thereof need not be made greater than the thickness of the disc. It is thus possible to reduce the axial length dimension of the ring-like projection. With the provision of no cylindrical surface or provision of a cylindrical surface with a reduced axial length direction, the

ring-like projection can be readily take out from the central hole of the disc even when the clamper is supported by a rocking member. It is thus possible to make the turntable and the clamper thinner. Further, since the cylindrical boss projects into the annular recess, it is possible to secure sufficient length of the bore, in which the motor shaft is fitted, without need of providing a boss projecting up to the other side of the disc holding surface. Even when the boss projects up to the other side of the disc holding surface, the extent of projection can be reduced, thus further reducing the axial dimension of the turntable.

Where the outer periphery of the ring-like projection has a cylindrical surface portion to be fitted in the disc center hole and a tapered or curved guide surface tapered from the cylindrical surface toward the end of the ring-like projection, it is possible to reliably prohibit the transfer movement of the disc in the plane direction thereof with the cylindrical surface and readily guide the disc center to the central position of the clamper with the guide surface.

Where the inner periphery of the ring-like projection has a tapered surface to be in contact with the edge of the end of the boss and the urging portion of the clamper is made elastically deformable, the tapered surface permits highly accurate aligning of the clamper and the turntable, and the elastic force of the urging portion permits the disc to be reliably held on the disc holding surface.

Where felt or like soft material is provided on at least part of the disc holding surface, it is possible to prevent

damage to the recording surface of the disc when loading and unloading the disc.

Where the outer periphery of the disc holding surface of the turntable has a tapered guide surface or the like for guiding the disc, the disc being horizontally transferred relative to the disc holding surface for loading, can be reliably guided onto the disc holding surface.

The above features and advantages of the present invention will now be more fully understood from the detailed description of the preferred exemplary embodiments when the same is read with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view showing a first embodiment of the disc clamping apparatus according to the invention in a state of holding a disc;

Fig. 2 is a side view showing the disc clamping apparatus according to the invention in a state of loading a disc on a turntable by raising a clamper therefrom;

Fig. 3 is a sectional view showing a second embodiment of the disc clamping apparatus according to the invention;

Fig. 4 is a bottom view showing a clamper in the apparatus shown in Fig. 3; and

Fig. 5 is a side view showing a prior art disc clamping apparatus.

A first embodiment of the invention will now be described with reference to Figs. 1 and 2.

Referring to these figures, a clamper 10 faces a turntable

11, the top of which has a disc holding surface 12 for prescribing the position of a disc 2 in its axial direction (Y-Y), and a cylindrical boss 16 having an axial bore 15 for receiving a shaft 14 of a motor 13, and an annular recess formed around the boss 16. The turntable 11 thus has no portion higher in level than the disc holding portion 12. The disc holding surface 12 is the top surface of the turntable 11. The underside of the clamper 10 has an urging portion 18 for holding the disc 2 on the disc holding surface 12, and a ring-like projection 19 for insertion through a central hole 5 of the disc 2 into the annular recess 17. The ring-like projection 19 is formed radially inwardly of the urging portion 18. Fig. 1 shows that the disc 2 is held clamped in a clamping position.

The disc 2 is movable to be transferred in a direction (X-X) perpendicular to the axial direction (Y-Y) of the turntable 11. The plane in which the disc 2 is transferred is parallel to the disc holding surface 12. The motor shaft 14 extends along the axis (Y-Y), and its upper end is flush with the upper end of the boss 16. The upper end of the boss is flush with or at least does not project from the disc holding surface 12. The turntable 11 is invariable in position in the axial direction (Y-Y) relative to the disc transfer plane (X-X), and is capable of rotation about the axis (Y-Y) only. The annular recess 17 noted above is defined between a cylindrical surface 16a as the outer periphery of the boss 16 and the inner periphery of the disc holding surface 12.

An end portion of the ring-like projection 19 has inner

and outer peripheral tapered guide surfaces 19a and 19b formed on its tip portion respectively. The inner periphery of the projection 19 has, as an inner peripheral portion, a cylindrical surface 19c extending from the guide surface 19a. The inner peripheral surface 19c of the projection 19 is capable of being fitted about the cylindrical surface 16a of the boss 16 for the alignment of the clamper 10 and the turntable 11 to each other. Thus, both the cylindrical surfaces 19c and 16a constitute aligning surfaces. The outer periphery of the projection 19 has a cylindrical surface 19d formed on its stem portion and extending from the guide surface 19b. The guide surfaces 19b taper from the cylindrical surface 19d so that the outer diameter of the guide surface 19b is gradually smaller toward the end of the tip portion than that of the cylindrical surface 19d. When clamping the disc 2 on the turntable 11, the disc 2 is manually transferred as shown by arrow in Fig. 2 with the clamper 10 in an upper set position which is then lowered as shown by arrow, thereby fitting the centre hole 5 of the disc 2 on the cylindrical surface 19d. It will be seen that the cylindrical surface 19d constitutes a prohibiting surface, which prohibits the transfer movement of the disc 2 in a direction (X-X) perpendicular to the axial direction (Y-Y) of the turntable. The guide surface 19b noted above and the cylindrical surface 19d constitute the outer periphery of the ring-like projection 19.

The outer periphery of the turntable 11, i.e., the outer periphery of the disc holding surface 12, has a tapered guide surface 11a. An a ring-like magnetic member (iron plate, for

instance) 20 is embedded in the top of the disc holding surface 12, and an annular permanent magnet 21 is provided inside the urging portion 18 of the clamper 10 such that it faces the magnetic member 20.

The motor 13 is coupled via its shaft 14 directly to the turntable 11 as described above, and is mounted on a chassis 22 of the disc clamping apparatus. The disc clamping apparatus is assembled in a CD player or the like via a buffering member, for instance.

With the disc clamping apparatus having the above construction, assembled in a CD player, the disc 2 can be loaded on and unloaded from the turntable 11 by merely horizontally transferring it in a direction (X-X) perpendicular to the axis (Y-Y) as shown by arrow in Fig. 2. It is thus possible to dispense with means for raising and lowering the disc or the turntable along the axis (Y-Y), making the CD player construction simpler and smaller in size.

Particularly, the loading and unloading of the disc is further facilitated because the turntable 11 has no portion higher in level than the disc holding surface 12.

In addition, accurate alignment of the clamper 10 and the turntable 11 can be obtained with the fitting of the cylindrical surface 19c of the ring-like projection 19 and the cylindrical surface 16a of the boss 16 in the annular recess 17. The tapered guide surface 19a provided on an end portion of the projection 19 facilitates the aligning of the clamper 10 and the turntable 11.

Moreover, the tapered guide surface 11a on the outer

periphery of the disc holding surface 12 of the turntable 11, permits the disc 2 being horizontally transferred to be readily led onto the disc holding surface 12.

While the first embodiment of the invention has been described, it is by no means limitative. For example, while the guide surface 19a is provided on the projection 19 of the clamper 10 to facilitate the aligning of the clamper 10 and the turntable 11, it is also possible to provide such a guide surface on the peripheral surface of the annular recess 17 of the turntable 11, or provide such guide surfaces on both the projection 19 of the clamper 10 and the peripheral surface of the annular recess 17 of the turntable 11.

In addition, by forming at least part of the disc holding surface 12 with felt or like soft material, an effect of protecting the data recording surface of the disc 2 can be obtained when loading and unloading the disc. It is further possible to provide curved guide surfaces instead of the tapered guide surfaces 19a and 19b to obtain the same effects.

Moreover, it is possible to interchange the magnetic member 20 and the magnet 21, that is, provide the magnetic member 20 on the side of the clamper 10 and provide the magnet 21 on the side of the turntable 11. At any rate, the invention is not limited to such magnet type disc clamping apparatus.

A second embodiment of the invention will now be described with reference to Figs. 3 and 4. Fig. 3 is a sectional view showing the disc clamping apparatus in a state of holding a disc 2 in the clamping position, and Fig. 4 is a bottom view of a clamper 40.

Referring to the figures, the upper side of a turntable 31 having a vertical axis (Y-Y), has a disc holding surface 32, which is parallel with a direction (X-X) perpendicular to the axis (Y-Y) and can hold the disc 2 loaded on it, and a cylindrical boss 36, which has an axial bore 35 through which the shaft 14 of a motor 13 is inserted and secured to it and also has a cylindrical surface 36a. An annular recess 37 is defined between the boss 36 and the disc holding surface 32. The upper end of the cylindrical boss 36 is substantially flush with and does not project from the disc holding surface 32. The outer periphery of the turntable 31 has a tapered guide surface 31a, which permits the disc 2 being transferred in the transfer plane (X-X) thereof to be smoothly led to the disc holding surface 32.

The clamper 40 is provided to face the disc holding surface 32. The underside of the clamper 40 has, as an urging portion, urging protuberances 41 for keeping the disc 2 held on the disc holding surface 32, and a ring-like projection 42 for being inserted through a center hole 5 of the disc 2 into the annular recess 17.

The ring-like projection 42 has an outer tapered or curved guide surface 42a formed on its tip portion as the outer diameter of the surface 42a is gradually smaller toward the end of the tip portion of the projection 42. Further the projection 42 has a central, upwardly tapered curved conical guide surface 42b. The turntable 31 and the clamper 40 are aligned to each other by the contact between the guide surface 42b and the edge 36b of the upper end of the cylindrical boss 36. The outer

periphery of the ring-like projection 42 has a cylindrical surface 42c formed on its stem portion and extending from the outer guide surface 42a. The cylindrical surface 42c is fitted in the center hole 5 of the disc 2 to prohibit movement of the disc 2 in the plane direction thereof, i.e., in the X-X direction.

The upper end edge 36b of the boss 36 constitutes an outer peripheral portion thereof with the cylindrical surface 36a. The annular recess 37 noted above is defined between the outer periphery 36a, 36b of the boss 36 and the disc holding surface 32.

Around the proximal end of the ring-like projection 42 are provided three elastically deformable resilient tongues 43 radially extending from the outer periphery. The urging protuberances 41 noted above, which are semi-spherical in shape, each project from the underside of the free end of each tongues 43 and face the disc holding surface 32.

With the second embodiment, in addition to the first embodiment, more accurate aligning of the clamper 40 and the turntable 31 can be obtained with the contact between the tapered guide surface 42b and the upper end edge 36b of the cylindrical boss 36.

In addition, since the urging protuberances 41 elastically push the disc 2 against the disc holding surface 32 with the elastic forces of the resilient tongues 43, the disc 2 can be reliably held on the disc holding surface 32 irrespective of slight fluctuations of the thickness of the disc 2.

In this embodiment, it is possible to provide a taper in

place of the upper end edge 36b of the cylindrical boss 36.

For the details of parts in the first embodiment like those in the first embodiment, the description thereof is applicable.

As has been described in the foregoing, according to the invention, since the turntable has no part projecting from the disc holding porion, the disc can be loaded on and unloaded form the turntable without transferring it in the axial direction. In addition, the turntable is invariable in its axial position relative to the plane of movement of the disc, and neither the turntable nor the disc need be transferred in the axial direction, so the construction can be simplified.

In addition, since the ring-like projection of the clamper is fitted in the center hole of the disc and also fitted on the cylindrical boss of the turntable, it need not have any outer peripheral cylindrical surface. Even when the ring-like projection has an outer peripheral cylindrical surface, the axial length dimension thereof need not be made greater than the thickness of the disc. It is thus possible to reduce the axial length dimension of the ring-like projection. With the provision of no cylindrical surface or provision of a cylindrical surface with a reduced axial length dimension, the ring-like projection can be readily taken out from the central hole of the disc even when the clamper is supported by a rocking member. It is thus possible to make the turntable and the clamper thinner.

Since the cylindrical boss projects into the annular recess, it is possible to secure sufficient length of the bore,

in which the motor shaft is fitted, without need of providing a boss projecting up to the other side of the disc holding surface.

Where the outer periphery of the ring-like projection has as stem formed with a cylindrical surface of a reduced length to be fitted in the disc center hole and a tapered guide surface tapered from the cylindrical surface toward the end of the ring-like projection, it is possible to reliably prohibit the transfer movement of the disc in the plane direction thereof with the cylindrical surface and readily guide the disc center to the central position of the clamper with the guide surface.

Where the inner periphery of the ring-like projection has a tapered surface to be in contact with the edge of the end of the boss and the urging portion of the clamper is made elastically deformable, the tapered surface permits highly accurate aligning of the clamper and the turntable, and the elastic force of the urging portion permits the disc to be reliably held on the disc holding surface.

Where felt or like soft material is provided on at least part of the disc holding surface, it is possible to prevent damage to the recording surface of the disc when loading and unloading the disc.

Where the outer periphery of the disc holding surface of the turntable has a tapered guide surface or the like for guiding the disc, the disc being horizontally transferred relative to the disc holding surface for loading, can be reliably guided onto the disc holding surface.

CLAIMS

1. A disc clamping apparatus comprising a turntable having a disc holding surface, a clamper facing said disc holding surface to let a disc being transferred in a disc transfer plane substantially parallel to said disc holding surface be held clamped in a clamping position on said disc holding surface, and a motor for rotating said turntable about the axis of said turntable, said motor having a shaft extending in the direction of said axis;

said turntable is invariable in position in the direction of said axis relative to said disc transfer plane;

said turntable has a cylindrical boss secured to said motor shaft, and an annular recess defined between the outer periphery of said cylindrical boss and said disc holding surface;

said boss does not project from said disc holding surface;

said clamper has an urging portion for urging said disc against said disc holding surface when clamping said disc on said disc holding surface, and a ring-like projection provided radially inwardly of said urging portion and for being inserted through a central hole of said disc positioned on said disc holding surface into said

annular recess;

said ring-like projection has an outer peripheral portion capable of being engaged in said central hole of said disc to prohibit transfer movement of said disc in the direction along said disc transfer plane; and

said ring-like projection has an inner peripheral portion capable of being engaged on the outer periphery of said cylindrical boss when it is inserted into said annular recess, thereby aligning said clamper and said turntable to each other.

2. The disc clamping apparatus according to claim 1, wherein said outer peripheral portion of said ring-like projection has a cylindrical surface formed on its stem portion and having a predetermined diameter, and a guide surface formed on its tip portion as the diameter of the guide surface is gradually smaller toward the end of the tip portion than that of said cylindrical surface, said cylindrical surface being held engaged in the inner peripheral surface of the centre hole of said disc when said disc is held clamped at said clamping position by said clamper.

3. The disc clamping apparatus according to claim 1

or 2, wherein said inner peripheral portion of said ring-like projection to be in contact with said cylindrical boss has a tapered or curved guide surface, said urging portion of said clamper elastically urging said disc against said disc holding surface when said disc is held clamped by said clamper in cooperation with said turntable.

4. The disc clamping apparatus according to claim 3 wherein said clamper has a plurality of radially outward extended resilient tongues, said urging portion being provided on the free end of each of said resilient tongues.

5. The disc clamping apparatus according to any preceding claim, wherein said disc holding surface of said turntable is made of a soft material.

6. The disc clamping apparatus according to any preceding claim, wherein the outer periphery of said turntable has a guide surface for smoothly guiding said disc being transferred in said disc transfer plane onto said disc holding surface.

7. A disc clamping apparatus substantially as any

one of the specific embodiments hereinbefore described with reference to, and as shown in, Figs. 1 to 4 of the accompanying drawings.